Spot Safety Project Evaluation

Project Log # 200512194

Spot Safety Project # 02-98-230

Spot Safety Project Evaluation of the Overhead Lane Control Signs and the Replacement of Yield Signs with Stop Signs
At the Intersection of US 17 and US 17 Business-NC 43
Craven County

Documents Prepared By:

Safety Evaluation Group
Traffic Safety Systems Management Section
Traffic Engineering and Safety Systems Branch
North Carolina Department of Transportation

Principal Investigator

_____ 7/25/2008
Brad Robinson, EI Date

Traffic Safety Project Engineer

Spot Safety Project Evaluation Documentation

Subject Location

Evaluation of Spot Safety Project Number 02-98-230 – The southern intersection of US 17 and US 17 Business-NC 43 in Craven County.

Project Information and Background from the Project File Folder

There were two spot safety project improvement countermeasures chosen for the subject location:

- The installation of overhead guide signs on northbound US 17 with supplemental arrows to better direct motorists.
- The replacement of the existing large yield signs with 48" dual stop signs at the intersection of northbound US 17B-NC 43 and southbound US 17. In addition, three Stop Ahead warning signs with "Left Lane" plaques (at 1500', 1000', and 500'), Stop Ahead pavement markings, and red flagging on one the stop signs were installed.

US 17 is a two-lane roadway that flares out to a short four-lane section as it approaches the intersection. The northbound movement onto US 17 Business-NC 43 was controlled by yield signs in the before period. The speed limit on all roads is 55 mph.

The original statement of problem was motorists unfamiliar with the intersection were either running through the yield condition because of their uncertainty over which direction to go or were hesitating at the point of decision and creating a hazard to other travelers.

The initial crash analysis was conducted from January 1, 1995 to December 31, 1997 with a total of nine crashes, eight of which were Angle Crashes and one was a Rear-End Crash. The final completion date for the improvements at the subject intersection was on March 5, 1999 with a total cost of $100,000.00.

Naive Before and After Analysis

After reviewing the spot safety project file folder along with all the crashes at the subject location, the crash data omitted from this analysis to consider for an adequate construction period was from January 1999 to April 30, 1999. The before period consisted of reported crashes from March 1, 1990 through December 31, 1998 (8 years and 10 months) and the after period consisted of reported crashes from May 1, 1999 through February 29, 2008 (8 years and 10 months). The ending date for this analysis was limited by the available crash data at the time the analysis was conducted.

The treatment data consisted of all reported crashes on northbound US 17 from where the overhead directional sign was placed to the intersection (approximately 2,000 feet), and all other crashes within 150 feet of the subject intersection.

The following data table depicts the Naive Before and After Analysis for the treatment location. Please note that Angle Crashes involving the northbound movement onto US 17 Business-NC 43 were the Target Crashes for the applied countermeasure. The target crashes are clearly identified in the before and after period collision diagrams.

Treatment Information			
	Before	**After**	**Percent Reduction (-) Percent Increase (+)**
Total Crashes	25	15	-40.0
Total Severity Index	27.92	15.05	-46.1
Target Crashes	12	1	-91.7
Target Crash Severity Index	46.45	8.4	-81.9
Volume	11,500	13,700	19.1
Crash Severity Summary			
Fatal Crashes	3	1	-66.7
Class A Crashes	5	1	-80.0
Class B Crashes	2	2	0.0
Class C Crashes	7	6	-14.3
PDO Crashes	8	5	-37.5

The naive before and after analysis at the treatment location resulted in a 40 percent decrease in Total Crashes, a 92 percent decrease in Target Crashes, and a 19 percent increase in Average Daily Traffic (ADT). The before period ADT year was 1994 and the after period ADT year was 2003.

Results and Discussion

The naive before and after analysis involving the comparison of treatment actual before data versus treatment actual after data resulted in a 40 percent decrease in Total Crashes and a 92 percent decrease in Target Crashes. The Total Severity Index decreased by 46 percent and the Target Crash Severity Index decreased by 82 percent. The summary results above demonstrate that both Total Crashes and Target Crashes appear to have decreased at the treatment location from the before to the after period.

The calculated benefit to cost ratio for this project is 35.49 considering total crashes. The benefit to cost ratio considering only target crashes is 41.35. The benefits are calculated using the change in annual crash costs from the before to the after period. Operational and other benefits related to the project are not considered in this analysis. The costs of the project include the actual construction costs as well as the increase in annual maintenance and utility costs.

The countermeasures appear to have been very effective at reducing Target Crashes at the subject intersection. Referencing the above table and *Collision Diagrams*, Angle Crashes involving the

movement onto US 17B-NC 43 from US 17 have reduced significantly, from 12 in the before period to only 1 in the after. The Target Severity Index also experienced a very large decrease (82%). Target Crashes resulted in three fatal crashes and five class 'A' crashes in the before period and the single after period crash resulted in a class 'C' crash.

In addition to the Target Crashes, there were other crashes in both the before and after period that might have been influenced by the overhead signs. The before period had a single Sideswipe-Same Direction Crash on northbound US 17, while there were two such crashes in the after period. Before Period Crash #11 (a Rear-End Crash) resulted from a vehicle quickly decelerating at the last second in an attempt to switch lanes before the gore. After period crash #9 (a Ran-Off-Road Crash) resulted from a vehicle attempting to change lanes just before the gore.

In both the before and after period there was a pattern of Angle Crashes at the intersection between vehicles attempting to travel northbound onto US 17 from US 17B-NC 43 and vehicles traveling southbound on US 17. In the before period there were five such crashes, resulting in one class 'B' crash and four class 'C' crashes. In the after period there were four such crashes, resulting in a Fatal Crash and three class "C' crashes. The movement from southbound US 17B-NC 43 to northbound US 17 is controlled by a stop sign. It appears that the vehicles were aware of the stop condition (in every crash the vehicle had either stopped or significantly slowed).

As the Safety Evaluation Group completes additional spot safety reviews for this type of countermeasure, we will be able to provide objective and definite information regarding actual crash reduction factors for this type of roadway.

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: US 17 at US 17B-NC 43 BY: BDR
COUNTY: Craven DATE: 7/7/2008
FILE NO.: SS 02-98-230

DETAILED COST: TYPE IMPROVEMENT - Overhead Guide Sign and replacement of yield signs with stop signs

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$0	0	0.000	$0
	$100,000	20	0.102	$10,185
Right-of-Way	$0	0	0.000	$0
TOTALS	$100,000	20	0.102	$10,185

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $50
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $0

TOTAL ANNUAL COST= $10,235
TOTAL COST OF PROJECT= $100,000

COMPREHENSIVE COST REDUCTION:

		ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES						
TIME PERIOD	YEARS	K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	PDO CRASHES	PDO CRASHES PER YR	ANNUAL COSTS
BEFORE	8.84	8	0.90	9	1.02	8	0.90	$502,692
AFTER	8.84	2	0.23	8	0.90	5	0.57	$139,423

Annual Benefits from Crash Cost Savings $363,269

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = $353,034

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 35.49

TOTAL COST OF PROJECT - $100,000 COMPREHENSIVE B/C RATIO - 35.49

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: US 17 at US 17B-NC 43 BY: BDR
COUNTY: Craven DATE: 7/7/2008
FILE NO.: SS 02-98-230 Target Crashes

DETAILED COST: TYPE IMPROVEMENT - Overhead Guide Sign and replacement of yield signs with stop signs

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$0	0	0.000	$0
	$100,000	20	0.102	$10,185
Right-of-Way	$0	0	0.000	$0
TOTALS	$100,000	20	0.102	$10,185

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $50
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $0

TOTAL ANNUAL COST= $10,235
TOTAL COST OF PROJECT= $100,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

TIME PERIOD	YEARS	K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	PDO CRASHES	PDO CRASHES PER YR	ANNUAL COSTS
BEFORE	8.84	7	0.79	2	0.23	3	0.34	$425,373
AFTER	8.84	0	0.00	1	0.11	0	0.00	$2,149

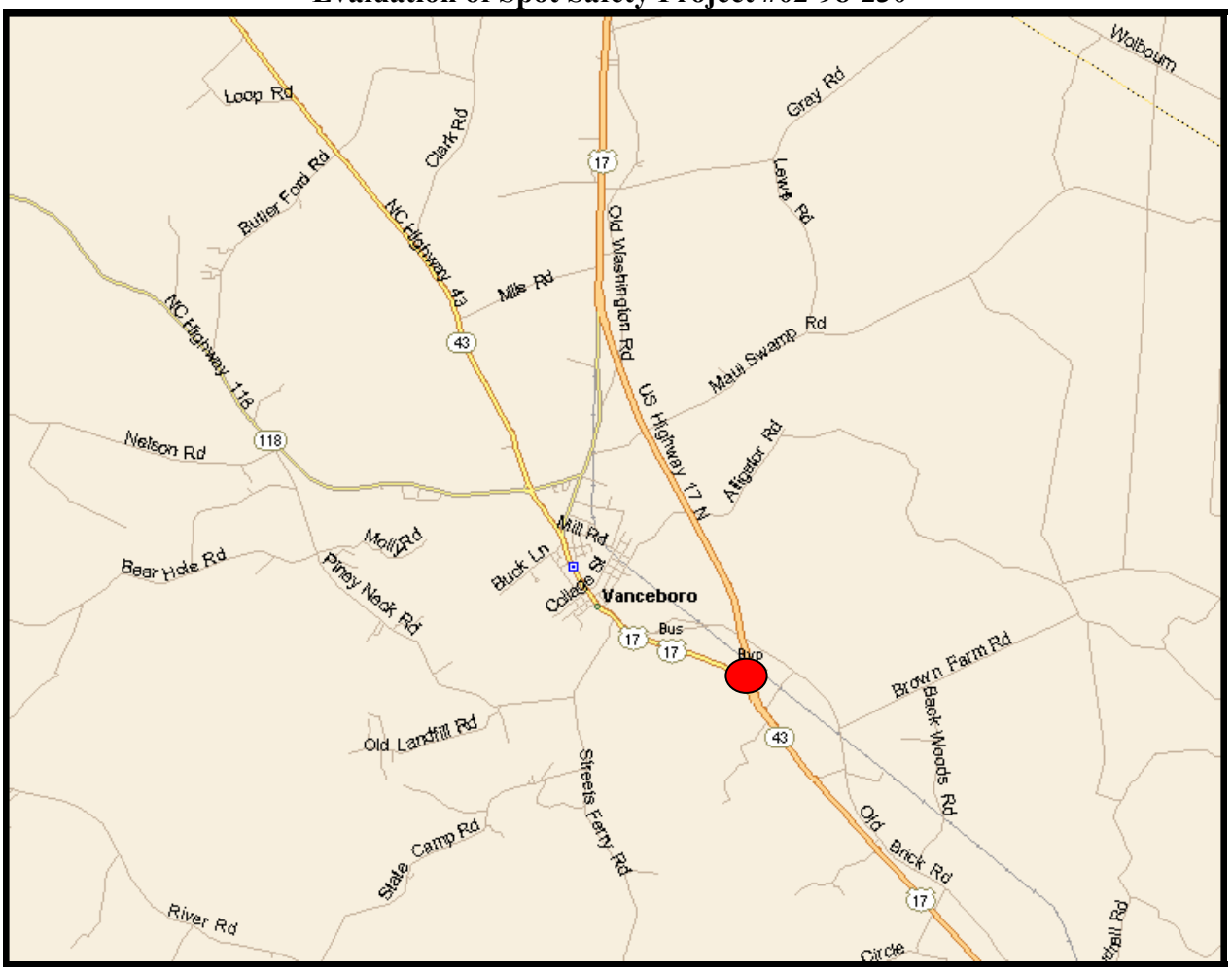
Annual Benefits from Crash Cost Savings $423,224

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = $412,989

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 41.35

TOTAL COST OF PROJECT - $100,000 COMPREHENSIVE B/C RATIO - 41.35

Location Map
Craven County
Evaluation of Spot Safety Project #02-98-230



Treatment Location: US 17 at US 17B-NC 43

Treatment Site Photos Taken May 14, 2008

Traveling Northwest on US 17

Traveling Northwest on US 17

Traveling Northwest on US 17

Traveling Northwest on US 17

Traveling Northwest on US 17 Approaching Intersection

Traveling Northwest on US 17 Approaching Intersection

Traveling Southeast on US 17

Traveling Southeast on US 17

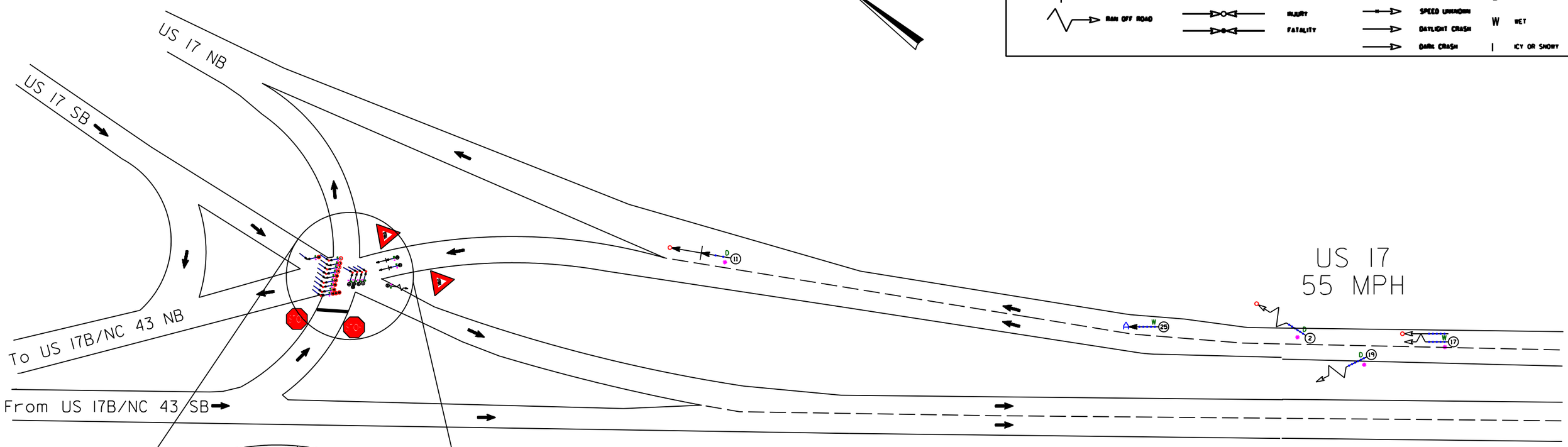
Traveling Southeast on US 17

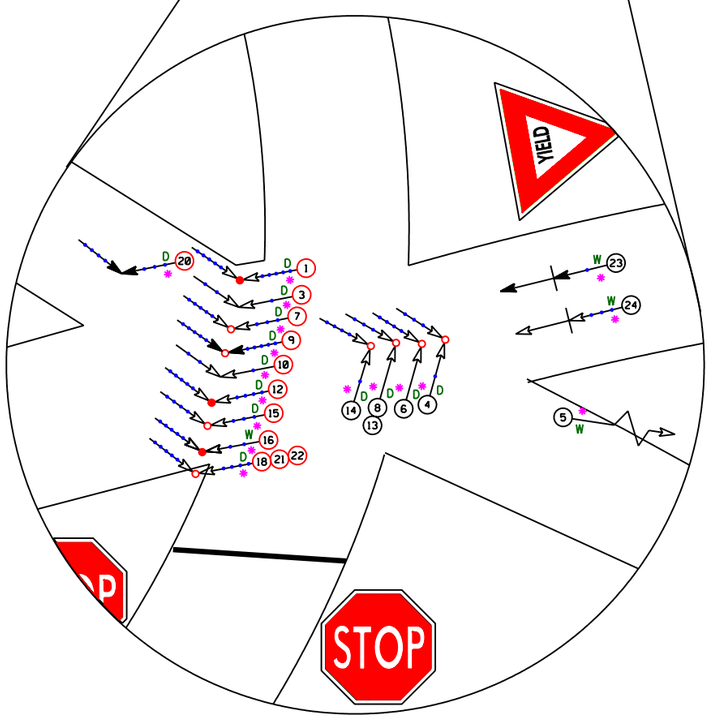
Traveling Southeast on US 17B / NC 43

Craven County
US 17 at US 17B/NC 43
Before Period
3/1/1990-12/31/1998

LEGEND

MOVING VEHICLE	ANGLE	9 MPH OR LESS	P	PEDESTRIAN
PEDESTRIAN		10 MPH TO 19	B	BICYCLE
PARKED VEHICLE	TURNING	20 MPH TO 29		
PARKING VEHICLE		30 MPH TO 39	T	TRAIN
MOVABLE OBJECT	BACKING	40 MPH TO 49	A	ANIMAL
HEAD ON	SIDESWIPE	50 MPH TO 59		
REAR END		60 MPH TO 69	•	DRIVER AT FAULT
RAN OFF ROAD	OUT OF CONTROL	70 AND UP	D	DRY
	INJURY	SPEED UNKNOWN	W	WET
	FATALITY	DAYLIGHT CRASH	I	ICY OR SNOWY
		DARK CRASH		





Note: Study limit includes northbound US 17 leading up to the intersection and those crashes within 150' of the intersection. The rest shown only for reference.

Target Crash

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

HIGHWAY SAFETY IMPROVEMENT PROGRAM — SAFETY INFORMATION MANAGEMENT AND SUPPORT

SAFETY EVALUATION — TRAFFIC SAFETY

BEFORE_SIGN_INSTALLATION

COLLISION DIAGRAM

DIVISION: 2	AREA: ..
STUDY PERIOD:	3/1/1990 TO 12/31/1998
DISTANCE:	Y-LINE: 0 FT
ANALYSIS PREPARED BY:	BDB
DIAGRAM PREPARED BY:	BDB
DIAGRAM REVIEWED BY:	----------
SCALE:	NOT TO SCALE
DATE:	JULY 2008
LOG NUMBER:	---------

N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY SYSTEMS BRANCH

Craven County
US 17 at US 17B/NC 43
After Period
5/1/1999-2/29/2008

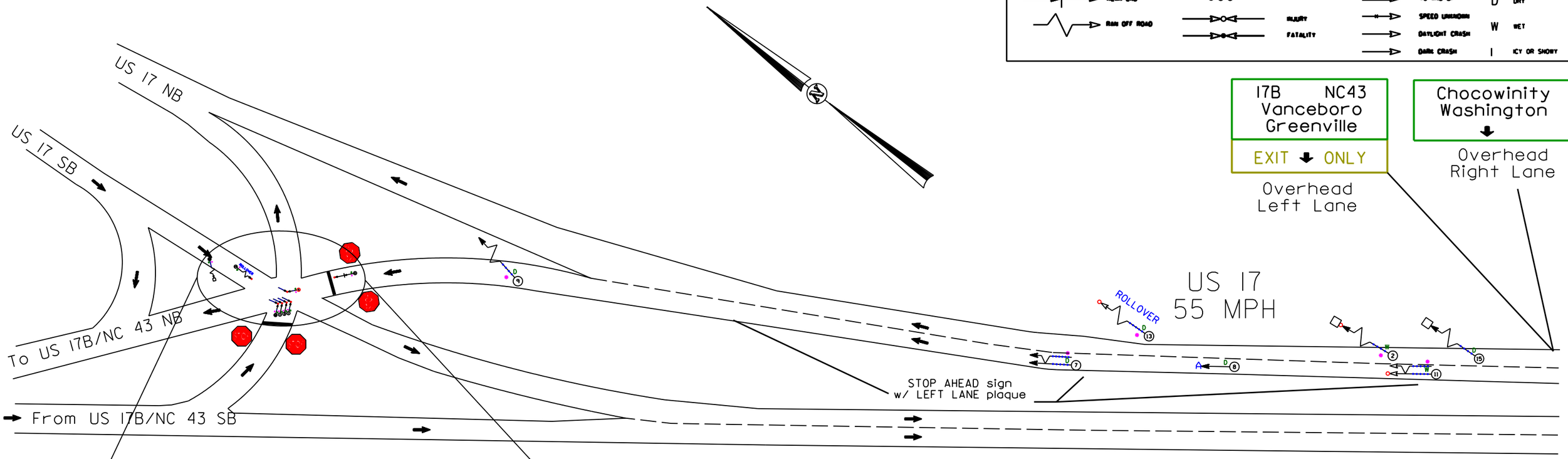
LEGEND

MOVING VEHICLE
PEDESTRIAN
PARKED VEHICLE
PARKING VEHICLE
MOVABLE OBJECT
HEAD ON
REAR END
RAN OFF ROAD

ANGLE
TURNING
BACKING
SIDESWIPE
OUT OF CONTROL
INJURY
FATALITY

9 MPH OR LESS
10 MPH TO 19
20 MPH TO 29
30 MPH TO 39
40 MPH TO 49
50 MPH TO 59
60 MPH TO 69
70 AND UP
SPEED UNKNOWN
DAYLIGHT CRASH
DARK CRASH

P PEDESTRIAN
B BICYCLE
T TRAIN
A ANIMAL
• DRIVER AT FAULT
D DRY
W WET
I ICY OR SNOWY



Note: Study limit includes northbound US 17 leading up to the intersection and those crashes within 150' of the intersection. The rest shown only for reference.

Target Crash

TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT
HIGHWAY SAFETY IMPROVEMENT PROGRAM
SAFETY INFORMATION MANAGEMENT AND SUPPORT
SAFETY EVALUATION
TRAFFIC SAFETY

AFTER SIGN INSTALLATION

COLLISION DIAGRAM

DIVISION: 2	AREA: ..
STUDY PERIOD:	5/1/1999 TO 2/29/2008
DISTANCE:	Y-LINE: 0 FT
ANALYSIS PREPARED BY:	BDB
DIAGRAM PREPARED BY:	BDB
DIAGRAM REVIEWED BY:	----------
SCALE:	NOT TO SCALE
DATE:	JULY 2008
LOG NUMBER:	---------

N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY SYSTEMS BRANCH